

## ABSTRACT OF THE DISCLOSURE

A method for in situ measurement of the strain and temperature of metal and composite tubulars located in the marine environment using optical fiber techniques including Optical Time Domain Reflectrometry (OTDR) or Bragg Diffraction Gratings. The method provides the capability to make axial, circumferential and off-axis strain measurements on the body of the riser and critical strain measurements in the metal to composite joint region typically used in composite risers. Through engineering analysis of the optical strain measurements, the method provides the capability to determine the bending strain and frequency of Vortex Induced Vibrations (VIV) imposed by marine ocean currents. The optical fibers of either glass or polymeric composition are located on the outside of either metal or composite risers following fabrication and bonded directly to the outer surface of the riser structural body and subsequently encapsulated in an outer protective cover. Bragg gratings are particularly valuable for making local strain and temperature measurements while the Optical Time Domain Reflectrometry method is ideally

suited for making global strain measurements such as the average strain over the entire length of a riser and for VIV monitoring. Multiplexing of the light signal allows monitoring of several plastic optical fibers and multiple segments within a fiber using a single light time-of-flight instrument. Strain measurements are transmitted to the surface either by a continuous optical fiber light path or by telemetry of a digitized signal.